

Screening for Disease

- The search for unrecognized disease by means of rapidly applied test, examination, or other procedures in an apparently healthy individual.
- It is based on Treberg phenomenon of the Disease.
- Screening test are done on apparently healthy and diagnostic test on sick.
- lead time is advantage gained by screening i.e., the period between the diagnosis by early detection and diagnosis by other means B-A.

Uses of Screening

- 1) Case Detection $\rightarrow$ Early detection. Eg. DM, CA.
- 2) Control of Disease $\rightarrow$ For Benefit of others. Eg. Infection.
- 3) Research purpose $\rightarrow$ Natural history of disease.
- 4) Educational purposes.

Types of Screening

- 1) Mass - Screening - Eg. TB, less Effective.
- 2) High Risk or Selective Screening.
 - Selectively to high risk groups Eg. CA cervix in low income group.
- 3) Multiphasic screening.
 - Two or more test, than using one test for finding disease.
 - Eg. CBlood, Urine, lung, visual, Audiometry at one time.

Criteria for Screening

Based on 2 considerations

i) Criteria for the disease.

ii) Criteria for the Screening Test

1) Criteria for the Disease

1) The disease should be important health problem

2) Recognizable latency or early asymptomatic stage

3) Natural history of the disease should be well understood (to know at what stage it ceases to be reversible)

4) There should be a test that can detect the disease prior to onset of symptoms & signs.

5) Facilities should be available for the confirmation of the diagnosis.

6) There is an effective treatment

7) There should be an cut off value to treat someone as patient (BP, Borderline diabetes)

8) Good evidence the early detection and treatment reduces mortality and morbidity

9) The expected benefits should be more than the exceed risks and costs.

When the above criteria are satisfied then only it would be appropriate to consider a suitable screening test

2) Criteria for Screening test

i) Acceptability ii) Repeatability iii) Validity.
besides simplicity, safety, rapidity,
ease of administration and cost.

1) Acceptability

- Since high cooperation is necessary it is important to be accepted.
- Tests causing pain, Discomfort, Embarrassment (Rectal or Vagina) are not usually accepted to population in mass campaigns.

2) Repeatability (Reliability, Precision + Reproducibility)

- The test must give consistent results when repeated more than once on the same individual under diff same condition.
- It depends upon three factors.

i) Observer variation ii) Biological variation,
iii) Error relating to technical methods.

1) Observer variation

a) Intraobserver variation : (With observer variation).

- Variation between observation by the same observer on the same object at same time.
- It is minimized by taking average of several duplicate measurement at same time.
Eg. Blood Pressure.

b) Inter-observer variation (Between observer variation)

- Variation between different observer on the same object or material.

- It is minimized by standardization of techniques, intense trainings, making use of 2 or more observers.
- Eg. X-ray, ECG etc.

ii) Biological Variation

- May be due to
 - i) changes in Parameter observed. Eg. Cerebral spasm +ve on one day, -ve on other day.
 - ii) variation in way patient perceive their symptoms and answer.
 - iii) Regression to the mean - values at the extremes of a distribution, to regress towards the mean on repeated measurement. Eg. BP, Diabetes.
- Minimized by Repeated measurement over time.
- iii) Errors relating to technical ^{method} reliability
 - Defective instrument, Faulty reagents.
 - Improper calibrations. Tests may be inappropriate.
 - So the repeatability is affected by all these things.

3) Validity (Accuracy)

- The extent the test accurately measures.
- It is the ability to distinguish those who have the disease from who don't.
- It has 2 components.
 - i) Sensitivity
 - ii) Specificity

The test is applied to a group of patients who are diagnosed as a ~~pre~~ disease, and also not having the disease and summarized in a table.

Screening test result	Diagnosis		Total
	Diseased	Not Diseased	
Positive	a (True Positive)	b (False Positive)	a + b
Negative	c (False Negative)	d (True Negative)	c + d
Total	a + c	b + d	a + b + c + d

Evaluation of a Screening test:

a) Sensitivity = $\frac{a}{a+c} \times 100$

b) Specificity = $\frac{d}{b+d} \times 100$

c) Positive Predictive Value = $\frac{a}{a+b} \times 100$

d) Negative Predictive Value = $\frac{d}{c+d} \times 100$

e) Percentage of False negative = $\frac{c}{a+c} \times 100$

f) Percentage of False Positive = $\frac{b}{b+d} \times 100$

Sensitivity

- Ability of the test to correctly identify all those who have disease.

- Ability to pick of True Positive.

- A 90% sensitive means, 90% True positive and 10% False negative.

- Answers the question what number of % of patient will be picked by test?

Specificity

- The ability of the test to identify who do not have disease.
 - Ability to pick true negative
 - 90% true negative - 10% False positive classified as disease when they are not
 - High Specificity means the ~~disease~~ ^{test} will not be positive in ~~all~~ only those specific disease
- Positive predictive value:
- Probability of actually having the disease when the test is positive.

Positive, negative value

- Probability of not having the disease when the test is negative.

False Negative & False Positive

↓ Sensitivity

↓ Specificity

- No screening test has 100% Sensitivity & Specificity.